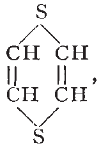
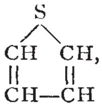
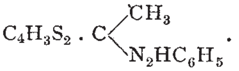
west of Haka, is undoubtedly the main stream of the Koladyne, which was so familiar in connection with General Tregear's movements. Captain Bythell, R.E., who was at first on the Chittagong side, accompanied General Symons on his tour southwards from Haka, and traced the stream to within twelve miles of where he had last seen it from the Blue Mountain side. It is satisfactory to have this confirmation of the statements sent by correspondents with the Field Force, particularly as the upper course of the Koladyne was unknown to our geographers. The total area of topography, by the way, covered by the operations of Captain Bythell's party, is put down at about five thousand square miles, while the surveyors on the Burmah side must also be credited with work on a similar scale. The new maps of the Chin-Lushai hills, when they come to be published, will no longer show those great blank spaces which have hitherto been so noticeable in the old issues.

IN Grinnell Land, at sea-level (81° 44′ N. lat.), the mean day temperature is above freezing-point from about June 13 to August 23, *i.e.* 72 days. It has been recently pointed out by Dr. Hann, that on the top of the Sonnblick, at a height of about 10,000 feet, and in 47° N. lat., the temperature returns above freezing-point about the same time (viz. June 8); but it is not till the end of September or beginning of October that it goes below that point again. On the other hand, the mean summer temperature on the Sonnblick is considerably lower than in Grinnell Land at sea-level.

BIOPHENE, 

, an entirely new compound intermediate between the fatty and aromatic series, and somewhat resembling thiophene in properties, has been prepared by Dr. Louis E. Levi, of the Massachusetts Institute of Technology, Boston (*Technology Quarterly*, May 1890). Thiophene, 

, was discovered by Prof. Victor Meyer in 1883; the discovery attracted considerable attention at the time, and has since led to the preparation of a whole series of derivatives analogous in many cases to those of benzene. Dr. Levi worked for some time in the laboratory of Prof. Meyer, and has subsequently followed up ideas then discussed, which have now resulted in the preparation of biophene. Just as thiophene is obtained by the action of phosphorus trisulphide upon succinic acid, so biophene is found to be produced by the action of trisulphide of phosphorus upon thio-diglycollic acid, $COOH—CH_2—S—CH_2—COOH$. A mixture of five grams of thio-diglycollic acid with ten grams of phosphorus trisulphide is heated, together with 15-20 c.c. of ether, in a sealed tube for two hours at a temperature of 170° C. After cooling, the end is opened at the blowpipe, when a great rush of accumulated sulphuretted hydrogen gas occurs. The contents of the tube are separated in the usual manner by means of a tap funnel, and washed with caustic potash solution. After withdrawing the alkali, the remaining oil is dissolved in ether and dried by means of fused calcium chloride. The ether is finally evaporated, and the residual oil fractionally distilled. As the result of this latter process, a liquid is eventually obtained boiling between 165° and 170°, which on analysis yields numbers agreeing with the formula of biophene, $C_4H_4S_2$. When biophene is mixed with sulphuric acid and a crystal of isatine added, a beautiful violet coloration is produced, a reaction which appears to be analogous to that of thiophene, which produces with sulphuric acid and isatine a dark blue coloration. Biophene also reacts with acid chlorides in presence of aluminium chloride like thiophene, thus with acetyl chloride aceto-bienone or bienyl acetyl ketone, $C_4H_3S_2 . CO . CH_3$, is produced, hydrochloric acid being eliminated. This ketone is a thick, heavy liquid which may be distilled in steam and possesses an aromatic odour somewhat resembling that of aceto-thienone. Heated alone aceto-bienone boils, but with decomposition, at 300°. Sunlight rapidly turns it dark brown. Aceto-bienone also reacts with phenylhydrazine with formation of a compound of the composition 
$C_4H_3S_2 . C \begin{cases} CH_3 \\ N_2HC_6H_5 \end{cases}$. The similarity of biophene in all the above reactions to thiophene and benzene is very striking, the replacement of two of the CH groups of benzene by sulphur not being accompanied by any very great change in chemical behaviour. The formation of biophene from thio-diglycollic acid, also affords another instance of the passage from the fatty series to bodies of aromatic properties, and biophene itself will stand as an additional link between the two series.

THE additions to the Zoological Society's Gardens during the past week include a Great Anteater (*Myrmecophaga jubata* ♀) from British Guiana, presented by the Directors of the Botanical Gardens, Demerara; an Egyptian Gazelle (*Gazella dorcas*) from Suakim, presented by Commander W. Crofton, R.N.; a Cape Ratel (*Mellivora capensis* ♀) from Suakim, presented by Captain J. F. M. Prinsep; a Jackal Buzzard (*Buteo jacal*), a —— Hawk Eagle (*Nisaetus spilogaster*) from Cape Colony, presented by Mr. W. H. Wormald; a Guillemot (*Lomvia troile*), British, presented by Mr. T. H. Nelson; a Greater Spotted Woodpecker (*Dendrocopus major*), British, presented by Mr. W. H. B. Pain; an Australian Crow (*Corvus australis*) from Australia, deposited; two Chinchillas (*Chinchilla lanigera*) from Chili, an Indian Chevrotain (*Tragulus meminna* ♂) from Ceylon, an Elate Hornbill (*Ceratogymna elata*), a White-necked Crow (*Corvus scapulatus*) from West Africa, a Large Grieved Tortoise (*Podocnemis expansa*) from the Amazon River, purchased.

OUR ASTRONOMICAL COLUMN.

OBJECTS FOR THE SPECTROSCOPE.

Sidereal Time at Greenwich at 10 p.m. on July 17 = 17h. 42m. 41s.

Name.	Mag.	Colour.	R.A. 1890.	Decl. 1890.
			h. m. s.	° ′
(1) G.C. 4361	—	—	17 57 9	−24 21
(2) G.C. 4415	—	—	18 22 44	+74 31
(3) 74 Herculis	5·5	Yellowish-red.	17 17 15	+46 21
(4) σ Ophiuchi	4	Yellow.	17 21 6	+ 4 14
(5) α Ophiuchi	2	White.	17 29 48	+12 38
(6) D.M. + 36° 3168 ...	8	Red.	18 28 31	+36 55
(7) R Lyræ	Var.	Reddish-yellow.	18 51 59	+43 48

Remarks.

(1) The spectrum of this remarkable nebula has not yet been completely examined. In 1868, Captain Herschel observed two lines in the spectrum, and, in addition, a decided continuous spectrum from the brightest point, which is "*not* stellar." These lines are stated to be ill-defined; and now that it is asserted by some observers that the nebula lines are always sharp, they should be re-examined with special reference to this point. Seeing that the brightest point is not a star, it will be well also to look for maxima of brightness in the con-

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tinuous spectrum, the usual flame comparisons being employed if necessary. In the General Catalogue the following description is added:—"A very remarkable object; very bright; exceedingly large; extremely irregular figure; with large cluster." Webb refers to it as "a splendid galaxy object, visible to the naked eye."

(2) This nebula was discovered by Tuttle in 1859, and, according to D'Arrest's observations in 1863, it would appear to be variable. It is oval in shape, 2′ long and 80″ broad, and is said to be "pretty bright." No attempt has been made, as far as I know, to determine its spectrum, to say nothing of any variations of spectrum which may accompany the supposed changes in brilliancy.

(3) This star is one of Group II. at a very late stage. Dunér states that "the bands 2, 3, 7, 8 are visible, but they are difficult to recognize as bands, because of their little width. The spectrum is almost of the same type as that of α Tauri." A special study should be made of the lines which accompany the bands, with special reference to how they differ either in position or intensity from the darkest lines in the solar spectrum.

(4 and 5) According to Vogel, these stars have very well developed spectra of the solar type and of Group IV. respectively.

(6) The spectrum of this star is a well-marked one of Group VI., the principal bands being very wide and dark. There is possibly also a trace of band 4 (λ 589).

(7) This variable will reach a maximum about July 24. Its spectrum is of the Group II. type, and is stated by Dunér to be one of the finest in the heavens. The range of variation is small—4·3–4·6—in a period which is not yet completely determined (46? days, according to Gore). Observations similar to those suggested for other variables of the same type should be made.

A. FOWLER.

PHOTOGRAPHS AND DRAWINGS OF THE SUN.—The Memoirs of the Royal Astronomical Society, vol. xlix. Part 2, 1887–89, have just been issued, and contain, with other papers, one presented by the late Father Perry in June 1889 on the above subject.

The areas of spots derived from the solar photographs of 1887, and published in the "Greenwich Observations," have been compared with similar values computed from the measures of the drawings made at Stonyhurst College Observatory. The area computed from the photographs, however, shows a decided general excess over those obtained from the drawings. An idea of the difference may be obtained from the values of the mean daily spotted area, that for 1887 taken from the photographs being 179, while the drawings give 171.

On 29 days penumbra are found in the drawings and not in the photographs, whilst such records occur on the photographs alone only 16 times; hence the greater area obtained from the photographs cannot be explained by a failure in the drawings to record faint spots and penumbral markings.

An attempt was made to compare the faculæ recorded on the drawings and on the photographs, but unsuccessfully, owing to the enormous excess obtained from the former over that computed from the latter. To eliminate this difference Father Perry suggested that the conditions necessary to obtain good photographs of faculæ may differ from that which is best for spots, and that, therefore, a twofold series of photographs may be necessary, one for spots and the other for faculæ. Two plates, showing sun-spot drawings in 1887, from the Stonyhurst series, accompany the memoir.

OBSERVATIONS OF THE ZODIACAL LIGHT.—Prof. Arthur Searle, in *Astron. Nachr.*, No. 2976, contributes a note on zodiacal light observations made at Harvard College Observatory during the last fifty years. With respect to the permanence of the ordinary western zodiacal light, the observations support the results obtained by previous observers, viz. that it must be considered as a very permanent phenomenon, and one subject only to slight variations in its degree of visibility, apart from atmospheric causes. Another principal subject of investigation was the normal distribution of light in the zodiac and its vicinity, and it is noted that the zodiacal bands, apparently forming a prolongation of the ordinary zodiacal light, were never seen at Harvard College. A number of permanent bands or belts of faint light, however, not confined to the zodiac, although certain portions of them follow the course of the ecliptic, are described in the records. A comparatively large number of observations of the phenomena of a feeble maximum of light in opposition to the sun, commonly known as *Gegenschein*, have been obtained. Prof. Searle thinks that the photometric observations of Müller and Parkhurst, which show that as an average asteroid approaches opposition its brightness increases by about 0·03 of a magnitude for every degree by which its phase is increased, may afford an explanation of this slight maximum of light in opposition to the sun, the light being reflected in this case from the meteoritic matter dispersed through the solar system. Indeed, if the amount of light received from a meteoritic particle be supposed to increase even proportionally to its phase, a maximum appears at opposition, while the law of increase in light assumed for the asteroids, was approximately proportional to the fourth power of the phase.

RING NEBULA IN LYRA.—The current number of *Comptes rendus* (July 7) contains a note by M. G. Rayet on a photograph of this nebula obtained at Bordeaux Observatory with an exposure of three hours. The photograph shows all the stars observed near the ring by Lord Rosse in 1844; the star with the signification 3, however, is double, whereas that astronomer, and later Prof. Hall, mapped it as triple. There is also a very definite indication of a nebulous star of the 14th or 15th magnitude, almost in the centre of the ring. Although this star has been observed by many astronomers (*e.g.* Hahn, Secchi, Lassell, Schultz, and Holden) and has been photographed by Gothard, other astronomers (viz. Herschel, D'Arrest, Lord Rosse, Hall, and Vogel) have observed the nebula when the star was not visible, and it does not appear on the photographs taken by the Brothers Henry previous to 1886. M. Rayet therefore concludes that the star is variable, and hopes to make such observations and obtain such photographs as will enable him to demonstrate the fact. Stars in or near nebulæ and clusters seem from recent investigations to be more subject to variability than those not so situated.

PHOTOGRAPHS OF STELLAR SPECTRA.—In the same number of *Comptes rendus* a note occurs by Admiral Mouchez, on some photographs of stellar spectra taken by the Brothers Henry at Paris Observatory, and presented by him to the Academy. Some of the photographs were obtained by means of a prism having an angle of 45° placed in front of the object-glass of the photographic equatorial, others by means of a prism having an angle of 22°; and Admiral Mouchez remarked that, although the results represented the first attempts in this direction, they compared very favourably with those obtained in America, where work of the same nature has been carried on for some time. It is noted that the Brothers Henry attribute the fuzziness of the lines in the spectra of stars like Altair to a high velocity of rotation and a great amount of agitation at the surface. The photographs are the beginning of an investigation into the chemical composition of stars and motion in line of sight, recently begun at this Observatory.

ON THE SUPERFICIAL VISCOSITY OF WATER.[1]

THE idea that liquids are endowed with a viscosity peculiar to the surface is to be found in the writings of Descartes and Rumford; but it is to Plateau that its general acceptance is due. His observations related to the behaviour of a compass needle, turning freely upon a point, and mounted in the centre of a cylindrical glass vessel of diameter not much more than sufficient to allow freedom of movement. By means of an external magnet the needle was deflected 90° from the magnetic meridian. When all had come to rest the magnet was suddenly removed, and the time occupied by the needle in recovering its position of equilibrium, or rather in traversing an arc of 85°, was noted. The circumstances were varied in two ways: first, by a change of liquid, *e.g.*, from water to alcohol; and, secondly, by an alteration in the level of the liquid relatively to the needle. With each liquid observations were made, both when the needle rested on the surface, so as to be wetted only on the under side, and also when wholly immersed to a moderate depth. A comparison of the times required in the two cases revealed a remarkable dependence upon the nature of the liquid. With water, and most aqueous solutions, the time required upon the surface was about *double* of that in the interior; whereas, with

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[1] Paper read before the Royal Society, by Lord Rayleigh, Sec.R.S., on June 5, 1890.

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